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<p>(21) International Application Number: PCT/CH99/00556</p> <p>(22) International Filing Date: 22 November 1999 (22.11.99)</p> <p>(30) Priority Data: 09/233,060 20 January 1999 (20.01.99) US</p> <p>(71) Applicant (for all designated States except CA US): SYNTHES AG CHUR [CH/CH]; Grabenstrasse 15, CH-7002 Chur (CH).</p> <p>(71) Applicant (for CA only): SYNTHES (U.S.A.) [US/US]; 1690 Russell Road, P.O. Box 1766, Paoli, PA 19301-1222 (US).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): SCHOLL, Christopher, Hargest [US/US]; 1409 Wren Lane, West Chester, PA 19382 (US).</p> <p>(74) Agent: LUSUARDI, Werther, Dr. Lusuardi AG, Kreuzbühlstrasse 8, CH-8008 Zürich (CH).</p>		<p>(81) Designated States: CA, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published With international search report.</p>
<p>(54) Title: SURGICAL CHISEL AND METHOD OF USING SAME</p> <div data-bbox="241 1102 1352 1325"> </div> <p>(57) Abstract</p> <p>The present invention relates to a surgical chisel for removing a section of bone. The surgical chisel includes a body (12) having a cannulation (24) which extends from the distal end (16) of the body (12) through at least a portion of the body (12) and is configured and dimensioned to receive a guide wire (G); and a blade (18) attached to the distal end (16) of the body (12) and having at least one sharp edge (25) for impacting bone. Introducing the guide wire (G) into the cannulation (24) guides the chisel (10; 110) to the section of bone to be removed. The present invention also relates to a method of removing a section of bone with a chisel (10; 110). The method includes the steps of inserting a portion of a guide wire (G) into a bone; guiding the chisel blade (18) to the section of bone along the guide wire (G); and impacting the chisel blade (18) into the bone to remove a section thereof.</p>		

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Surgical chisel and method of using same

The present invention is directed to a surgical tool, and in particular a surgical chisel defined in the preamble of claim 1 and 12 and method for removing bone defined in the preamble of claim 26.

A guide wire is a flexible wire, usually metallic, used to ensure the proper positioning and placement of a surgical instrument and/or implant. The use of guide wires for orthopaedic applications is well known. For example, cannulated bone screws are widely available. In use, a guide wire is inserted in the desired location, the location of the guide wire is radiographically confirmed, and the guide wire is inserted in the cannulation of the bone screw to guide the bone screw to the implantation site. Cannulated drill bits and hole taps are also available as related instrumentation to facilitate the implantation of the bone screw.

Cannulated blade plates are also widely available. A blade plate, an implant used in various surgical procedures including osteotomies and internal fracture fixation, has a blade extending at an angle from a bone plate. The blade is inserted into the bone while the plate is secured to the bone surface with screws. In some clinical situations, a chisel having a cutting member corresponding in size and shape to the blade is used to create a pathway in the bone for the blade. Although blade plates are available with blades having a wide variety of configurations, the blade (or at least the individual elements that form the blade) are flat elongated members. As a result, it is difficult and costly to manufacture a blade or a chisel with a cannulation. More importantly, forming a cannulation in the blade increases the blade size. The increased size necessitated by the cannulation and the resulting adverse consequences (e.g. stress shielding, excessive removal of bone, etc.) can be particularly problematic in the small sized blade plates which are typically used for infants, children, and adults of modest stature. Unfortunately, chisels are ordinarily used in these patient populations.

In an effort to capitalize on the benefits of guide wires yet eliminate the complications associated with cannulations, alternative implant designs have been developed. U.S. Patent Nos. 2,222,517 and 2,239,088 and Soviet Union No. 571,255 disclose a fracture

fixation nail having a groove for a guide wire. U.S. Patent No. 2,496,126 discloses a nail/plate fixation device with webs forming a channel for a guide wire. U.S. Patent Nos. 3,025,853 and 3,486,500 both disclose an implant that has an aperture for an introducer in which the aperture is located on a bone plate and does not extend through the portion of the implant driven into bone. U.S. Patent No. 4,978,349 discloses a plate with a guide wire groove.

In spite of these advancements in implant design, very little has been done to improve on chisels that can be used with guide wires. Thus, there exists a need for an improved chisel and method for using a chisel in conjunction with a guide wire.

The present invention is directed to a surgical chisel for removing a section of bone. The surgical chisel includes a body having a first end, a second end, and a cannulation which extends from the second end through at least a portion of the body and is configured and dimensioned to receive a guide wire; and a blade attached to the second end of the body and having top and bottom surfaces and a sharp edge for impacting bone. Introducing the guide wire into the cannulation guides the chisel to the section of bone to be removed.

The invention solves this problem using a surgical chisel with the features of claim 1 and 16 as well as method of removing a section of bone with a chisel with the steps of claim 26.

Further advantageous designs of the invention are stated in the dependent claims.

In one embodiment, the cannulation extends completely through the body from the second end to the first end. In an alternative embodiment, the body has a rectangular cutout defined by a front edge, a back edge, and two side edges and the cannulation extends from the second end of the body to the front edge of the cutout. In order to assess bone impaction, the body can have markings located along at least one of the cutout side edges. The blade can also have markings for assessing bone impaction.

In a preferred embodiment, the surgical chisel includes a channel extending along the bottom surface of the blade. The channel is contiguous with the cannulation so that a

guide wire introduced into the channel slides along the channel and cannulation as the blade impacts the bone.

The body of the surgical chisel may also include a pin located adjacent the first end of the body. The pin is configured and dimensioned to receive a slotted hammer to remove the chisel from the bone.

The blade can have a cross section that is substantially T-shaped. If the surgical chisel is to be used in conjunction with an implant insertable into the bone, the blade cross section substantially conforms in shape and size to that of the implant.

The present invention is also directed to a method of removing a section of bone with a chisel. The method includes the steps of inserting a portion of a guide wire into a bone; guiding the chisel blade to the section of bone along the guide wire; and impacting the chisel blade into the bone to remove a section thereof.

The method can also involve inserting a plate into the void created by the removal of the section of bone and removing the guide wire from the bone. In one embodiment, the step of removing the guide wire from the bone precedes the step of inserting the blade plate into the void. In a preferred embodiment, the chisel body includes a cannulation for receiving and guiding the guide wire to the bone.

FIG. 1 shows a top view of a first embodiment of the surgical chisel according to the present invention;

FIG. 2 shows a side view of the surgical chisel of FIG. 1;

FIG. 3 shows a perspective view of a portion of the surgical chisel of FIG. 1;

FIG. 4 shows a top view of a second embodiment of the surgical chisel according to the present invention;

FIG. 5 shows a side view of an alternative embodiment of the surgical chisel according to the present invention;

FIG. 6 shows a perspective view of a portion of the surgical chisel of FIG. 5;

FIG. 7 shows an osteotomy plate that can be used with the surgical chisel according to the present invention;

FIG. 8 shows another osteotomy plate that can be used with the surgical chisel according to the present invention; and

FIG. 9 shows a perspective view of a surgical chisel according to the present invention in use.

FIG. 1 shows a top view of a first embodiment of a surgical chisel 10 according to the present invention. Chisel 10 has a body 12 with a longitudinal axis 23, proximal 14 and distal 16 ends, and a chisel blade 18 attached to distal end 16 of body 12. In order to facilitate impaction into bone, the tip 29 of chisel blade 18 has at least one sharpened edge 25. Chisel blade 18 has a bottom surface 26, a top surface 27 and can also have markings 20 on the top surface 27 for measuring the impaction into bone. A pin 22 is located near proximal end 14 of body 12 for receiving a slap or slotted hammer or other instrument to assist in driving and removal of chisel 10. A cannulation 24 extends parallel to the longitudinal axis 23 from distal end 16 through at least a portion of body 12 so that a guide wire G introduced into cannulation 24 guides chisel 10 to the section of bone B to be removed (FIG. 9). It should be noted that because body 12 has a block-like shape, manufacturing or machining cannulation 24 in body 12 is much simpler and more inexpensive than providing the flat elongated chisel blade 18 with a cannulation.

As seen best in FIG. 2 and FIG. 3, a bottom surface 26 of chisel blade 18 is provided with a channel 28 extending parallel to the longitudinal axis 23. Channel 28 is contiguous with cannulation 24 so that guide wire G introduced into channel 28 slides along channel 28 and into cannulation 24 as chisel blade 18 is impacted into bone B (FIG. 9). As long as channel 28 is sized to receive guide wire G, channel 28 can have any suitable cross-section, e.g. semicircular, U-shaped, or V-shaped. Running guide wire G through channel 28 and cannulation 24 helps prevent lateral (left to right) movement of guide wire G. Using channel 28 on chisel blade 18 instead of providing

chisel blade 18 with a cannulation has several advantages. First, the difficulties and expense of manufacturing a chisel blade with a cannulation are avoided. It is much cheaper and easier to manufacture a chisel blade with a channel. Additionally, the mechanical strength of a blade with a groove is greater than a blade with a cannulation. Also, the chisel blade does not have to be oversized to accommodate the cannulation. As a result, the blade of the associated blade plate also does not have to be oversized. FIG. 4 shows a top view of a second embodiment of a surgical chisel 110 according to the present invention. In general, most of the structure of chisel 110 is like or comparable to the structure of chisel 10. Accordingly, the same reference numeral is used for like components and discussion of these components is not believed necessary. Chisel 110 has cannulation 24 for receiving guide wire G to guide chisel 110 to the section of bone B to be removed. Unlike chisel 10, chisel 110 does not have channel 26 on chisel blade 18 (seen best in FIG. 5 and FIG. 6). Experimental studies have indicated that even without a channel on the chisel blade, a guide wire through cannulation 24 of chisel 110 can still effectively direct chisel 110 to the desired location.

FIG. 1 and FIG. 4 illustrate another important difference between chisel 10 and chisel 110. In chisel 110, cannulation 24 extends completely through body 12. In chisel 10, cannulation 24 extends through only a portion of body 12. Body 12 of chisel 10 has a cutout 30 defined by a front edge 32, a back edge 34, and two side edges 36 so that cannulation 24 extends from distal end 16 of body 12 to front edge 32 of cutout 30. Providing chisel 10 with cutout 30 further simplifies the manufacturing and reduces the production cost of the chisel. Furthermore, as the free end of the guide wire can be visualized, cutout 30 provides an additional means for determining the depth of impaction of chisel blade 18 into bone. In this regard, body 12 has indicia 38 located near side edges 36 of cutout 30 for assessing impaction into bone. It should be noted that chisel 110 can be provided with a cutout identical to cutout 30. Stated differently, the use of a cutout does not depend on the presence or absence of a channel on the blade.

Chisel 10, 110 can be used in various clinical applications, including those in which bone is being removed without the subsequent implantation of an implant such as a blade plate. In situations in which chisel 10, 110 is to be used in conjunction with a blade plate, the cross section of chisel blade 18 substantially conforms in shape and

size to the cross section of the blade of the blade plate. For example, FIG. 7 shows a blade plate 40 having a blade 42 that has a T-shaped cross section. As seen best in FIG. 3 and FIG. 6, the cross sections of chisel 10, 110 are T-shaped and substantially conform to the cross section of blade 42. Blade 42 has a groove 44 and an aperture 46 for a guide wire. As it is expected that after chisel 10, 100 has removed the desired amount of bone there will be a tight press fit between the blade of the blade plate and the remaining bone, the blade plate can only be implanted at the desired location and in the desired orientation. Therefore, chisel 10, 110 can be used with an appropriately sized and shaped conventional blade plate that does not have either a cannulation, channel, groove, or any other feature for accommodating a guide wire (as long as the guide wire is removed from the bone before the blade plate is implanted). FIG. 8 shows such a blade plate 48.

The present invention also relates to a method of using chisel 10, 110 and such a method is now described referring primarily to FIG. 9. In use, the surgeon inserts guide wire G under fluoroscopy or other image intensification to monitor the positioning of the guide wire. Once satisfied with the location of guide wire G, the surgeon runs the free end of guide wire G through cannulation 24 so that chisel 10, 110 will be properly positioned. A chisel guide (not shown) can be placed on the exterior of chisel 10, 110 so that the surgeon can align the chisel blade 18 with the longitudinal axis L of bone B. Using a hammer or other driving instrument, the surgeon then impacts chisel blade 18 into bone B. In this regard, markings 20 and/or indicia 38 can be used to determine the depth of penetration of chisel blade 18. After the desired depth of penetration has been achieved, the chisel blade is removed from bone B. As previously noted, pin 22 can be used to facilitate removal of chisel blade. If a blade plate such as blade plate 40 (i.e. having some structural feature to accommodate guide wire G) is to be used, then the surgeon runs the free end of guide wire G through aperture 46. Alternatively, guide wire G can be removed before the blade plate is implanted.

While it is apparent that the illustrative embodiments of the invention herein disclosed fulfil the objectives stated above, it will be appreciated that numerous modifications and other embodiments may be devised by those skilled in the art. Therefore, it will be understood that the appended claims are intended to cover all such modifications and embodiments which come within the scope of the present invention.

CLAIMS

1. A surgical chisel for removing a section of bone comprising:
 - A) a body (12) having a first end (14), a second end (16); and
 - B) a blade (18) attached to the second end (16) of the body (12) and having top and bottom surfaces (26;27) and at least one sharp edge (25) for impacting bone, characterized in that
 - C) the body (12) further comprises a cannulation (24) which extends from the second end (16) through at least a portion of the body (12) and is configured and dimensioned to receive a guide wire (G).
2. Surgical chisel according to claim 1, characterized in that introduction of a guide wire (G) into the cannulation (24) guides the chisel (10;110) to the section of bone to be removed.
3. Surgical chisel according to claim 1 or 2, characterized in that it further comprises a channel (28) extending along the bottom surface (26) of the blade (18) and being contiguous with the cannulation (24) so that a guide wire (G) introduced into the channel (28) slides along the channel (28) and cannulation (24) as the blade (18) impacts the bone.
4. Surgical chisel according to one of the claims 1 to 3, characterized in that the body (12) includes a pin (22) located adjacent the first end (14) of the body (12), the pin (12) being configured and dimensioned to receive a slotted hammer to remove the chisel (10;110) from the bone.
5. Surgical chisel according to one of the claims 1 to 4, characterized in that the blade (18) has markings (20) for assessing bone impaction.
6. Surgical chisel according to one of the claims 1 to 5, characterized in that the blade (18) has a cross section that is substantially T-shaped.

7. Surgical chisel according to one of the claims 1 to 6, characterized in that the cannulation (24) extends completely through the body (12) from the second end (16) to the first end (14).
8. Surgical chisel according to one of the claims 1 to 6, characterized in that the body (12) has a rectangular cutout (30) defined by a front edge (32), a back edge (34), and two side edges (36), the cannulation (24) extending from the second end (16) of the body (12) to the front edge (32) of the cutout (30).
9. Surgical chisel according to claim 8, characterized in that the body (12) has markings (38) located along at least one of the cutout side edges (36) for assessing bone impaction.
10. Surgical chisel according to one of the claims 1 to 9, characterized in that the body (12) has a block-like shape with a longitudinal axis (23).
11. Surgical chisel according to claim 10, characterized in that the cannulation (24) extends parallel to the longitudinal axis (23).
12. A surgical chisel for preparing a bone to receive an implant (40;48) insertable into a bone, the chisel comprising:
- A) a body (12) having a first end (14), a second end (16); and
 - B) a blade (18) attached to the second end (16) of the body (12) and having top and bottom surfaces (26;27), at least one sharp edge (25) for impaction into the bone, characterized in that
 - C) the blade (18) has a cross section substantially conforming in shape and size to that of the implant (40;48); and
 - D) the body (12) further comprises a cannulation (24) which extends from the second end (16) through at least a portion of the body (12) and is configured and dimensioned to receive a guide wire (G).
13. Surgical chisel according to claim 12, characterized in that the introduction of the guide wire (G) into the cannulation (24) guides the chisel (10;110) as the blade (18) impacts the bone.

14. Surgical chisel according to claim 12 or 13, characterized in that it further comprises a channel (28) extending along the bottom surface (26) of the blade (18) and being contiguous with the cannulation (24) so that a guide wire (G) introduced into the channel (28) slides along the channel (28) and cannulation (24) as the blade (18) impacts the bone.

15. Surgical chisel according to one of the claims 12 to 14, characterized in that the body (12) includes a pin (22) located adjacent the first end (14) of the body (12), the pin (22) being configured and dimensioned to receive a slotted hammer to remove the chisel (10;110) from the bone.

16. Surgical chisel according to one of the claims 12 to 15, characterized in that the blade (18) has markings (20) for assessing bone impaction.

17. Surgical chisel according to one of the claims 12 to 16, characterized in that the blade cross section is substantially T-shaped.

18. Surgical chisel according to one of the claims 12 to 17, characterized in that the cannulation (24) extends completely through the body (12) from the second end (16) to the first end (14).

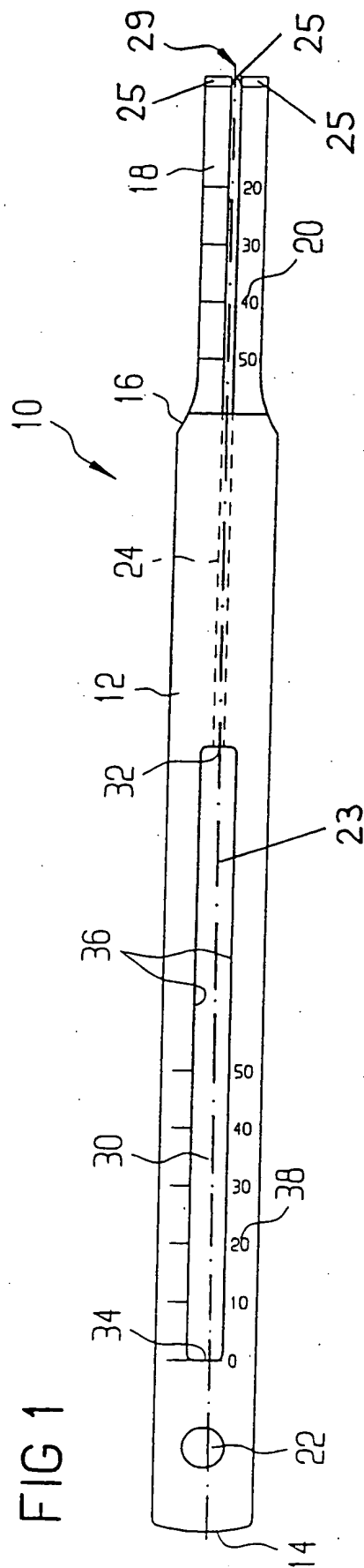
19. Surgical chisel according to one of the claims 12 to 17, characterized in that the body (12) has a rectangular cutout (30) defined by a front edge (32), a back edge (34), and two side edges (36), the cannulation (24) extending from the second end (16) of the body (12) to the front edge (32) of the cutout (30).

20. Surgical chisel according to claim 19, characterized in that the body (12) has markings (38) located along at least one of the cutout side edges (36) for assessing bone impaction.

21. Surgical chisel according to one of the claims 12 to 20, characterized in that the body (12) has a block-like shape with a longitudinal axis (23).

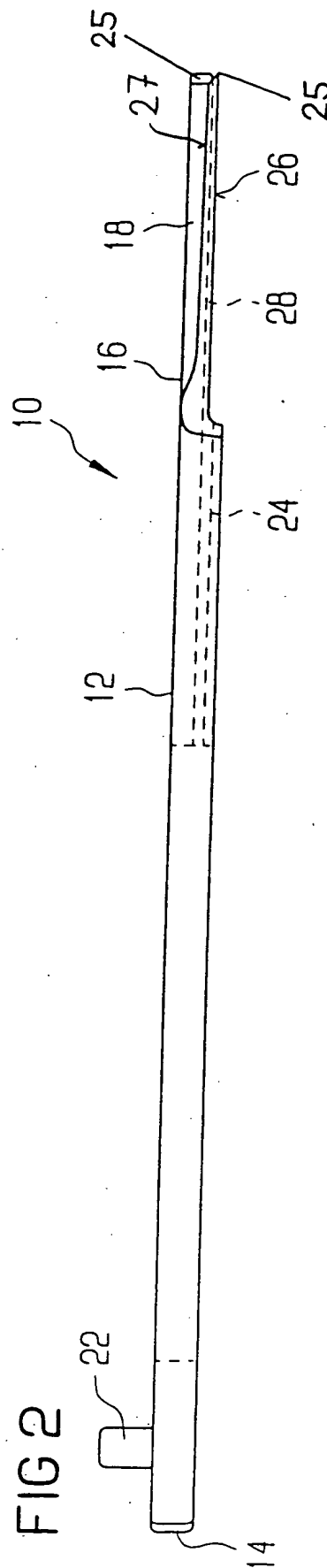
22. Surgical chisel according to claim 21, characterized in that the cannulation (24) extends parallel to the longitudinal axis (23).
23. Surgical chisel according to one of the claims 12 to 22, characterized in that in further comprises a blade plate (40;48) insertable into a bone.
24. Surgical chisel according to claim 23, characterized in that the blade plate (40;48) has a blade (42) with a T-shaped cross section.
25. Surgical chisel according to claim 23 or 24, characterized in that the blade (42) has a groove (44) and an aperture (46) for the acceptance of a guide wire (G).
26. A method of removing a section of bone with a chisel (10;110) having a chisel body (12) attached to a chisel blade (18), characterized in that it comprises the steps of:
- A) inserting a portion of a guide wire (G) into a bone, the guide wire (G) having a proximal end and a distal end, the proximal end being inserted into the bone;
 - B) guiding the chisel blade (18) to the section of bone along the guide wire (G); and
 - C) impacting the chisel blade (18) into the bone to remove a section thereof.
27. Method of claim 26 further comprising the steps of:
- D) inserting a plate (40;48) into the void created by removing the section of bone; and
 - E) removing the guide wire (G) from the bone.
28. Method according to claim 26 or 27, characterized in that the step of removing the guide wire (G) from the bone precedes the step of inserting the blade plate (40;48) into the void.
29. Method according to one of the claims 26 to 28, characterized in that the chisel body (12) includes a cannulation (24) for receiving and guiding the guide wire (G) to the bone.

FIG 1



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FIG 2



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FIG 3

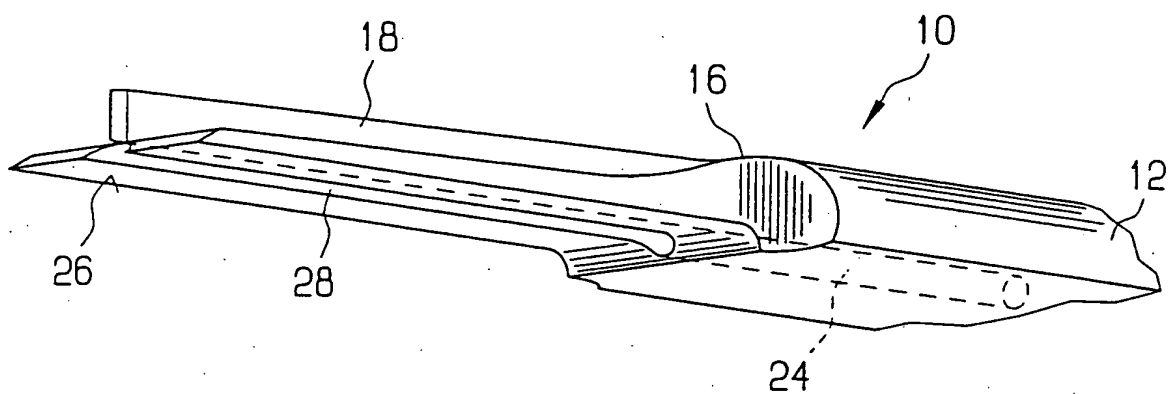
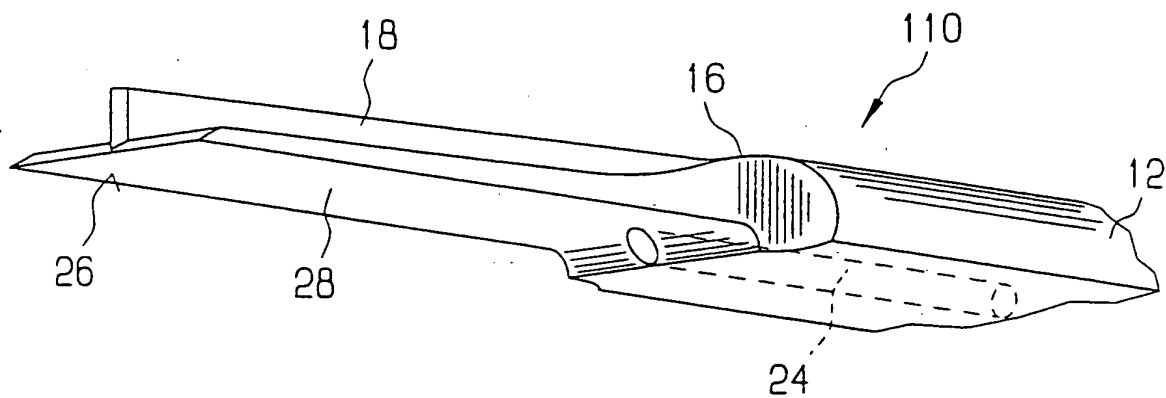


FIG 6



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FIG 4

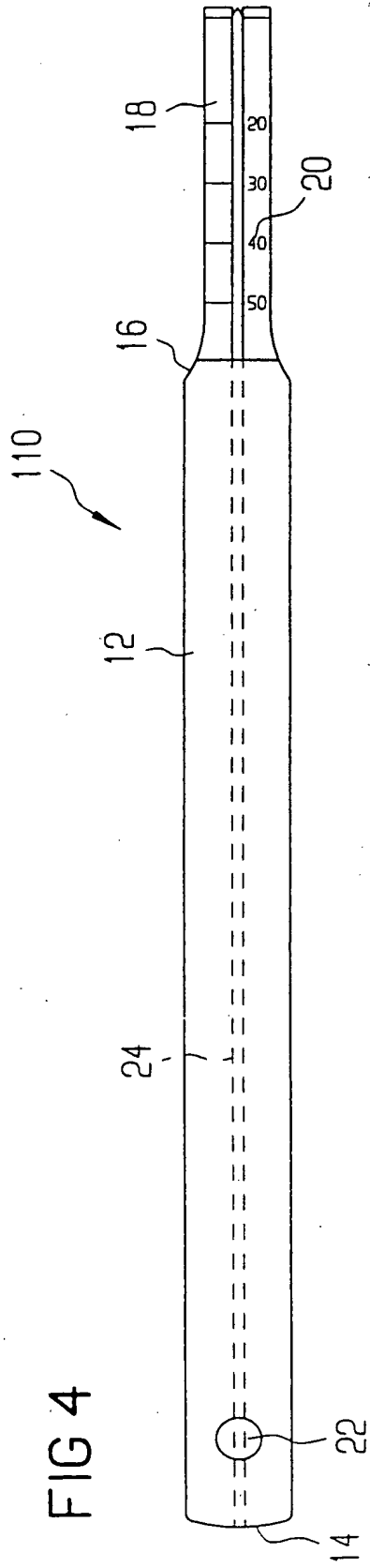
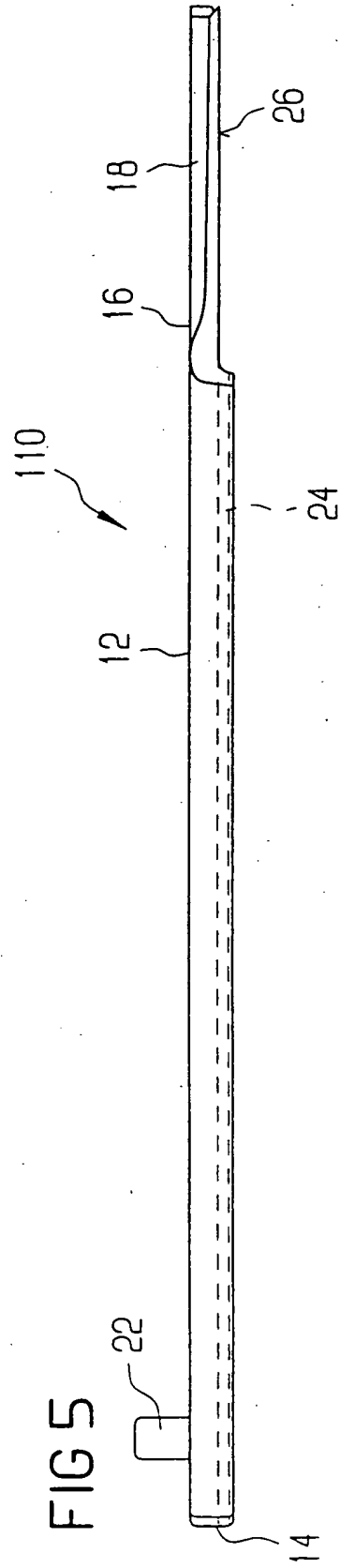


FIG 5



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FIG 7

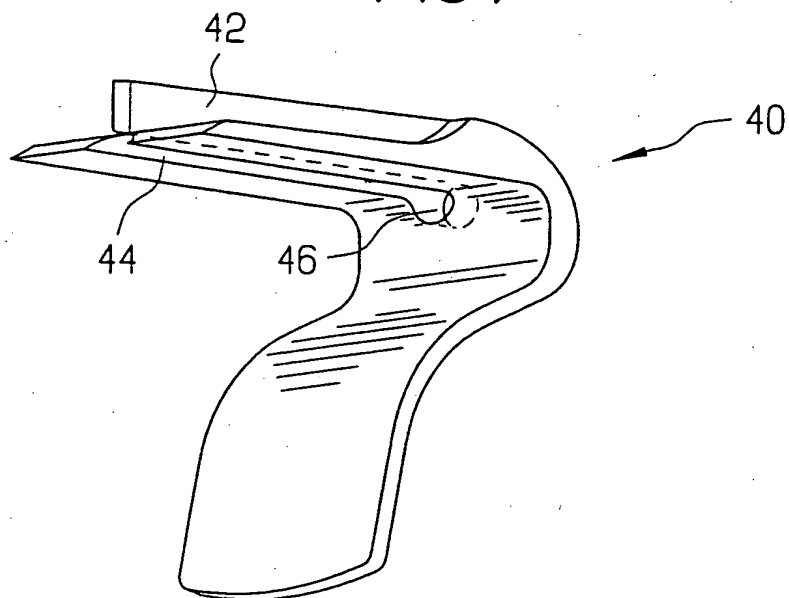


FIG 8

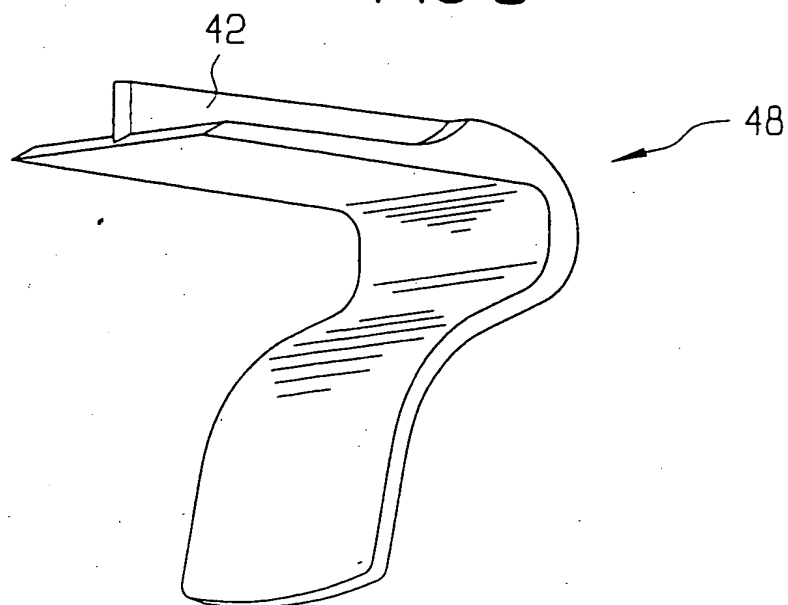
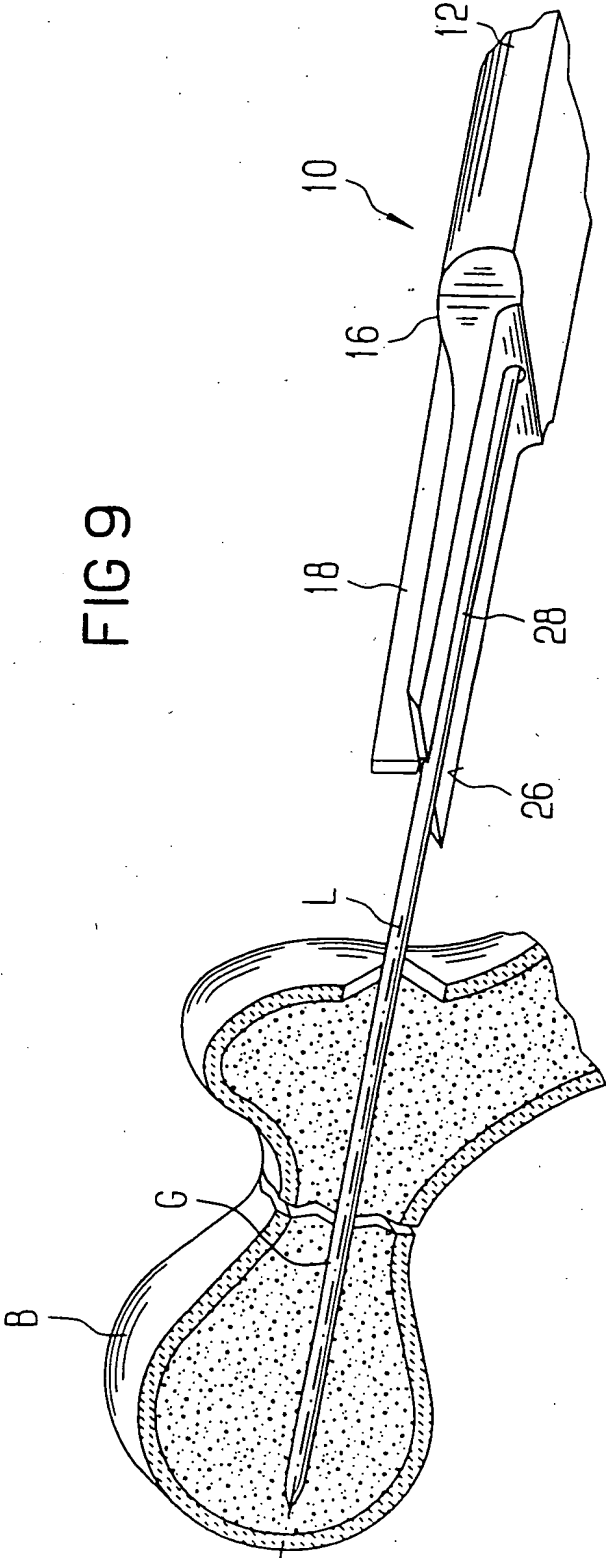


FIG 9



INTERNATIONAL SEARCH REPORT

International Application No

PCT/CH 99/00556

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61B17/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 758 712 A (TORNIER SA) 31 July 1998 (1998-07-31)	1-4, 7
A	page 5, line 26 - page 6, line 16; figure 5	12-25
X	US 4 881 537 A (HENNING CHARLES) 21 November 1989 (1989-11-21)	1-5
A	column 6, line 35 - line 58; figures 12, 13	12-25
A	US 4 881 534 A (UHL RICHARD L ET AL) 21 November 1989 (1989-11-21)	1, 6, 12
	abstract; figures 1, 2	
A	US 5 437 675 A (WILSON FRANKLIN D) 1 August 1995 (1995-08-01)	1, 9, 12
	column 3, line 49 - line 57; figure 2	
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

22 February 2000

Date of mailing of the international search report

01/03/2000

Name and mailing address of the ISA

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Hansen, S

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CH 99/00556

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2 496 126 A (HABOUSH E J) 31 January 1950 (1950-01-31) cited in the application the whole document	1,12
A	US 2 222 517 A (PRICE J W) 19 November 1940 (1940-11-19) cited in the application the whole document	1,12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CH 99/00556

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 26-29
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CH 99/00556

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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